CHP
Combined Heat & Power
in Kentucky

Getting Started with CHP

Cheryl Eakle

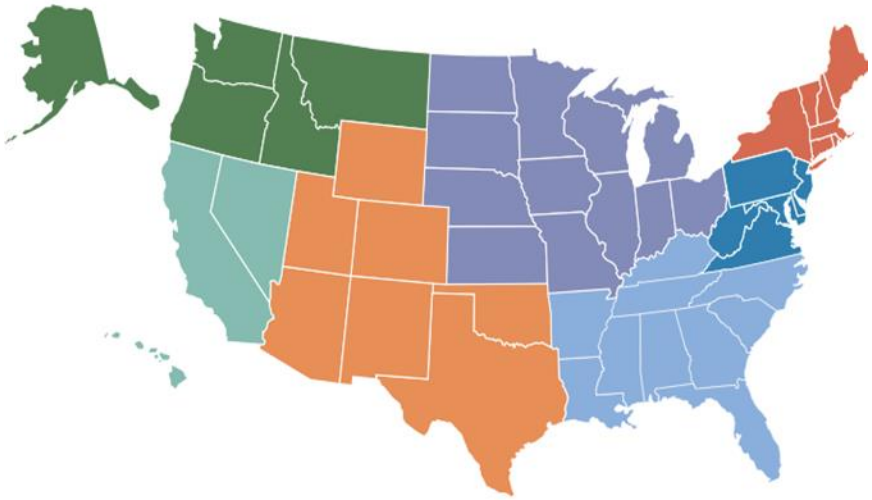
Sustainability Engineer

KPPC

CHP Technical Assistance Partnerships

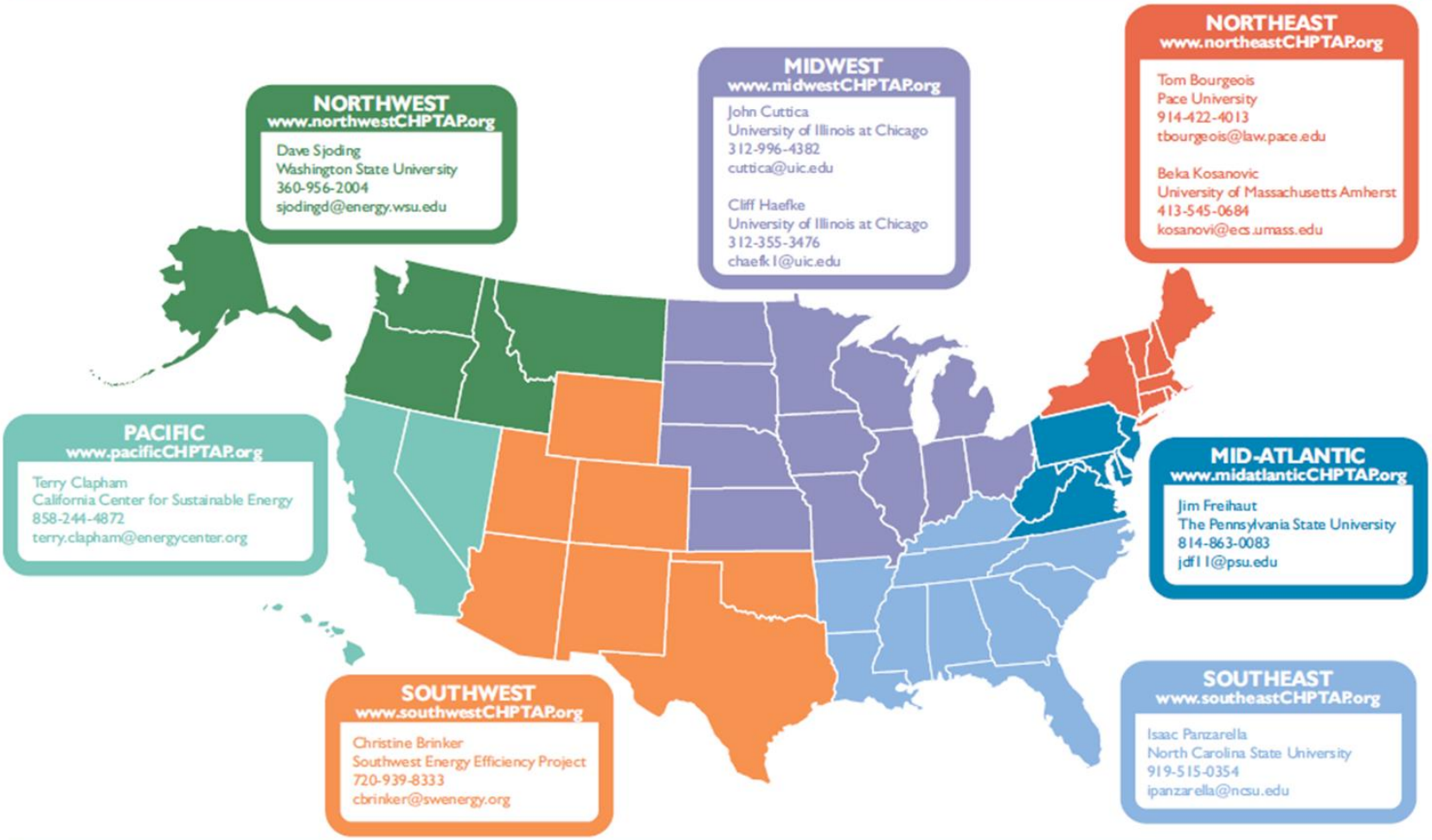
Key Activities

- **Market Opportunity Analysis**
  Supporting analyses of CHP market opportunities in diverse markets including industrial, federal, institutional, and commercial sectors
- **Education and Outreach**
  Providing information on the energy and non-energy benefits and applications of CHP to state and local policy makers, regulators, end users, trade associations, and others.
- **Technical Assistance**
  Providing technical assistance to end-users and stakeholders to help them consider CHP, waste heat to power, and/or district energy with CHP in their facility and to help them through the development process from initial CHP screening to installation.



http://eere.energy.gov/manufacturing/distributed energy/chptaps.html

DOE CHP Technical Assistance Partnerships (CHP TAPs)



DOE CHP Technical Assistance Partnerships (TAPs): Program Contacts

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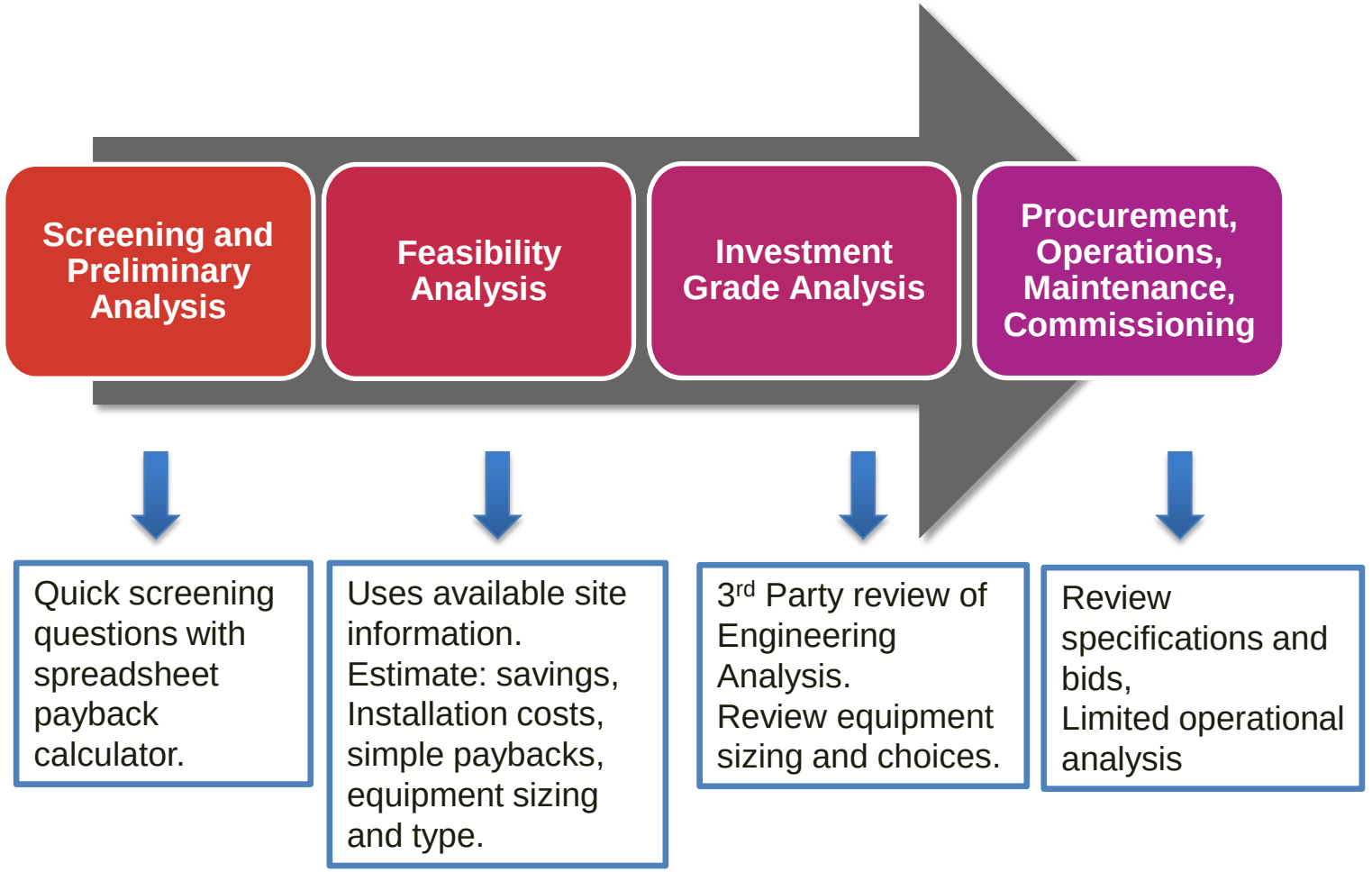
CHP

Where to start?

How can I determine if CHP is a good fit for my facility?

CHP TAP Technical Development Assistance



CHP Initial Screening

CHP Combined Heat & Power in Kentucky

Kentucky CHP TAP Qualification Screening

Reciprocating Gas CHP System - no power export from site

Facility Information		
Facility Name	Hospital	
Location (City, State)	Somewhere, KY	
Application	In-Patient Care	
Annual Hours of Operation	8760	
Annual Electricity Consumption (kWh)	16,061,600	
Average Power Demand (MW)	1.83	
Annual Fuel Consumption (MMBtu)	53,953.00	
Annual Thermal Demand (MMBtu)	43,162.4	2012-2013 Actual Fuel Consumption times ~ 80% efficiency
Average Thermal Demand (MMBtu/hr)	4.9	
Average Electricity Costs ($/kWh)	$0.065	2012-2013 Average Electricity cost
Thermal Fuel Costs ($/MMBtu)	$5.030	2012-2013 Average Fuel cost
CHP Fuel Costs ($/MMBtu)	$5.030	
Percent Electric Price Avoided	80%	
CHP System		
Net CHP Power (MW)	1.20	
CHP Electric Efficiency, % (HHV)	38.0%	
CHP Thermal Output (Btu/kWh)	4,260	
CHP Power to Heat Ratio	0.80	Calculated based on CHP power output and thermal output
CHP Availability (%)	95%	90 to 98%
Incremental O&M Costs ($/kWh)	$0.010	
Displaced Thermal Efficiency (%)	80.0%	Displaced onsite thermal (boiler, heater, etc) efficiency
Thermal Utilization (%)	100.0%	Amount of available thermal captured and used - typically 80 to 100
Stand-by Electric Required? (1=Yes, 0=No)	0	
Required Standby Capacity (kW)		
Standby Charge ($/kW)		

Effective Electric Cost

Effective Cost or “All-in Cost”

$$\frac{\text{Total Electric Bill (\$)}}{\text{Total Electric Use (kWh)}}$$

CHP Initial Screening

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CHP Initial Screening

Annual Energy Consumption

	Base Case	CHP Case
Generated Electricity (kWh)	0	9,986,400
Purchased Electricty (kWh)	16,061,600	6,075,200
CHP Thermal (MMBtu)	0	42,542
On-site Thermal (MMBtu)	43,162	620
Boiler Fuel (MMBtu)	53,953	775
CHP Fuel (MMBtu)	0	89,667
Total Fuel (MMBtu)	53,953	90,443

Annual Operating Costs

Purchased Electricity [Operating] ($)	$1,044,004	$524,711
Standby Electric Charges ($)	$0	$0
Total Electric Charges ($)	$1,044,004	$524,711
On-site Thermal Fuel ($)	$271,384	$3,900
CHP Fuel ($)	$0	$451,027
Incremental O&M ($)	$0	$99,864
Total Operating Costs ($)	$1,315,388	$1,079,502

Simple Payback

Annual Operating Savings ($)	$235,885
Installed Costs ($/kW)	$2,000
Total Installed Costs ($)	$2,400,000
Simple Payback, Years	**10.2**

Operating Costs to Generate

Fuel Costs ($/kWh)	$0.045
Thermal Credit ($/kWh)	($0.027)
Incremental O&M ($/kWh)	$0.010
Total Operating Costs to Generate ($/kWh)	**$0.028**

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Feasibility Analysis

A DOE CHP TAP Feasibility Analysis usually involves:

- Baseline Energy Analysis
  - Electrical load profiling
  - Thermal load profiling
- CHP Equipment Selection and Sizing

  Matching technology to thermal needs, size, fuel availability, and unique requirements (duct firing, thermal, reliability considerations)
- Analysis Assumptions

  Energy Costs-electric rates and fuel prices

  CHP System Costs-installed equipment costs, O&M, interconnection

Feasibility Analysis, continued

- **Feasibility Analysis**
  - Facility Energy Profiles on baseline and CHP Options
  - Economic Analysis – operating savings, payback/IRR/ROI
  - Sensitivity Analysis
  - Emissions Analysis
- **Recommended Next Steps**

Feasibility Analysis

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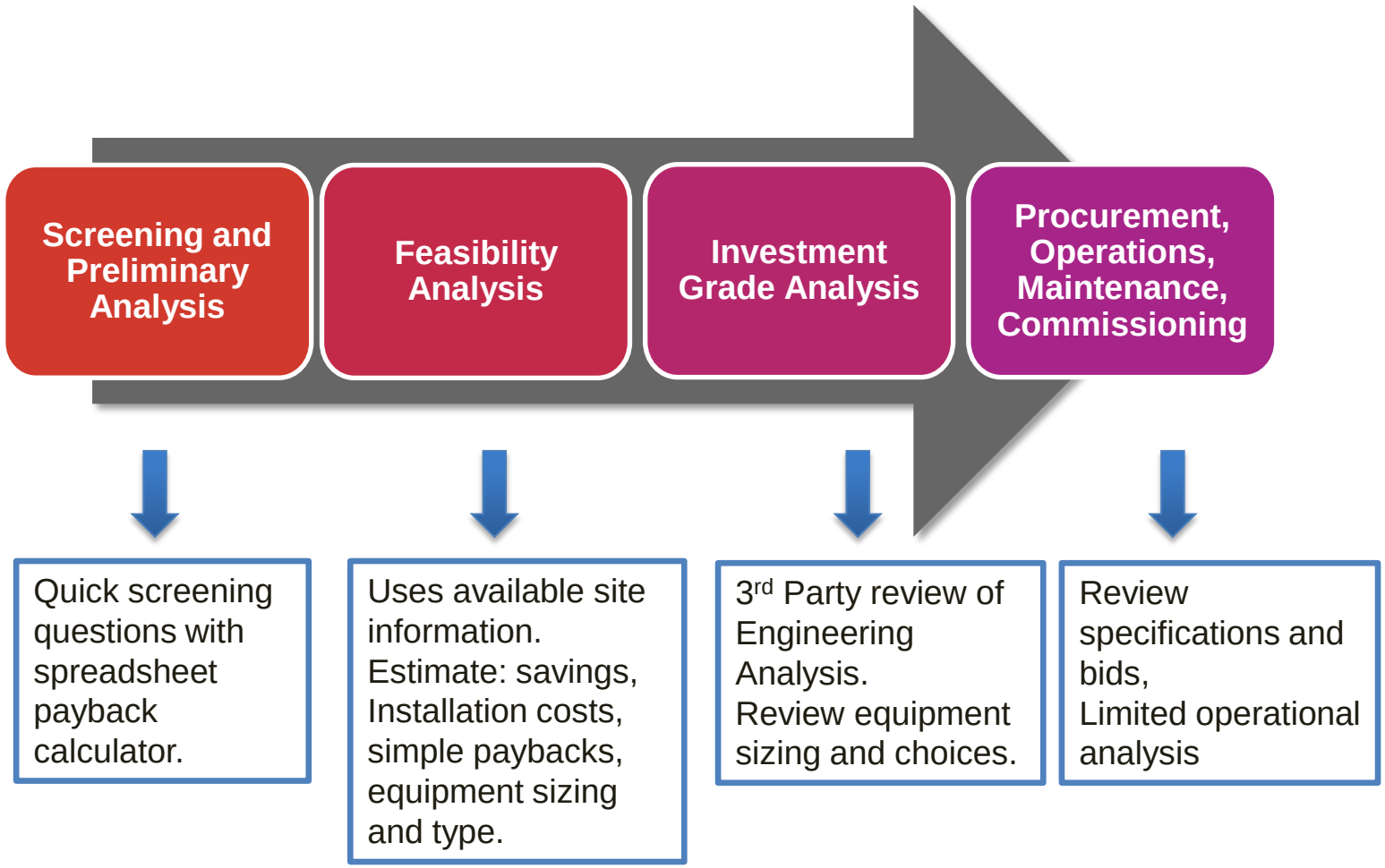
CHP TAP Technical Development Assistance



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